

## **Historic, Archive Document**

Do not assume content reflects current scientific knowledge, policies, or practices.



1.9  
Em 83 Ps

LIBRARY  
RECEIVED  
MAR 24 1925

PRESENT STATUS OF ESTABLISHMENT IN THE UNITED STATES  
OF

IMPORTED BULB PESTS  
(Report of Bulb Pests Survey)

Prepared by C. A. Weigel, Bureau of Entomology.

Introduction.

The Bureau of Entomology was requested by the Federal Horticultural Board to obtain reliable information and facts concerning the establishment and injuriousness in the United States of the insect pests that attack bulbs, especially the lesser bulb fly, Eumerus strigatus Fallén, and the larger narcissus or daffodil fly, Merodon equestris Fab., as well as the bulb mite, Rhizoglyphus hyacinthi Boisd.

During the months of June and July, 1925, some of the more important bulb growing sections of the Pacific Coast were visited, and after returning from there several days were spent investigating conditions in the bulb plantings around Norfolk, Va. Early in October, plantations of old and naturalized stock were examined in the vicinity of Wilmington, N. C. Some of the leading bulb growers, as well as various State officials, were interviewed on this survey and personal examinations were made of growing and dug bulbs to determine the status of the above named pests.

Methods of Inspection.

Inspections were made, either directly in the field at the time of digging, or on samples of bulbs that were dug in my presence, or else of bulbs in storage houses which had been dug only a few days before. In general, the size of the samples examined varied from a few to several hundred bulbs of a given variety, the actual number depending on the quantity available for such use. In three instances, however, the samples contained 970, 1,000 and 2,000 bulbs, respectively. An inspection consisted first of sorting out and laying aside all bulbs that on external appearance showed any defects or bruises or were soft to the touch. Then these damaged or suspected bulbs were cut open to determine whether their poor condition was caused by infestation with insects and mites. Many apparently healthy bulbs were also cut open in order to verify their freedom from pests. Records were kept of the total number of healthy and affected bulbs examined as well as the number that were found to be infested, and in this way definite information was obtained showing the actual percentage of infestation. A summary of the findings is here given.





### Conditions on the Pacific Coast.

Both species of the bulb flies were found in many of the older plantings examined on the West Coast. The bulbs in most of these plantings had been growing there from two to five years. In one instance the flies were encountered in a field of bulbs the stock of which was nine years old.

A total of 27 plantings examined in the States of California, Oregon, and Washington showed that the lesser bulb fly was present in 19, and the narcissus fly in 17. Presumably if time had been available or if other circumstances had been such as to permit a very exhaustive and thorough inspection of the bulbs in each planting, both species of flies might have been found in some of the plantings that are here reported as apparently uninfested.

This statement must not be construed as meaning that the growers were unwilling to have such an examination made. On the contrary, all of them were very courteous and extended the fullest cooperation in placing their stocks at our disposal.

The percentages of infestation shown by some of these examinations represent the actual condition and degree of infestation of unculled bulbs at the time of digging and storage, whereas imported bulbs when received for inspection at the port of entry are supposed already to have been culled and freed from damaged or pest infested material.

The various bulb pests of the Pacific Coast treated herein are discussed under separate headings.

#### The Narcissus or Saffodil Fly.

This foreign insect is recognized as a serious pest of narcissus and a bulb once attacked by it is usually destroyed and of no further commercial value. While this pest was encountered in 17 out of a total of 27 plantings on the Pacific Coast, the degree of infestation for individual lots or samples of dry bulbs varied greatly, the maximum being 15% of the bulbs in the sample examined. An analysis of these figures by States brings out certain facts.

In California, this fly was found in 7 out of 18 lots examined. The percentages of infestation in these cases were as follows: 1%, 3.3%, 4.6%, 5%, 7.8%, 8%, and 15%.

In Oregon it was found in 7 out of 8 places. Where definite records were made, a total of 22 lots of bulbs was examined, 7 of which were infested. The percentage of infestation was less than 1% in 5 lots and was 4% in the other





2 lots. In one instance, a few larvae were found infesting 2 varieties of narcissus out of 6 that were examined. In another instance, 2 flats of Golden Spur bulbs imported during the fall of 1924 and forced in the greenhouse during the past winter were free from infestation, while one flat of imported Victoria bulbs forced under the same conditions showed an infestation of 6.6%.

In Washington five plantations were infested. Of the 6 lots examined, 2 showed infestations of 11.4% and 12.5% respectively; one was estimated at 15% and the other three were not determined.

#### The Lesser Bulb Fly.

An examination of the table again reveals some interesting facts with reference to the degree of infestation of this insect in the three Pacific Coast States. In general, the degree of infestation was rather light as shown by the following data. A total of 55 lots of bulbs was examined, and the degree of infestation was as follows:

- 21 were uninfested.
- 8 were so slightly infested that the percentage was not determined.
- 13 had less than 1%.
- 7 had from 1% to 5%.
- 2 had from 7.1% to 8.9%.
- 1 was estimated at 15%.
- 2 had from 47.6% to 52.7%.

The last two lots included Van Waveren Giant bulbs that had an infestation of 47.6% based on an examination of 21 bulbs, and Golden Spur bulbs with an infestation as high as 52.7%, based on an examination of 110 bulbs. In the same field, however, four varieties of narcissus, namely; Paper Whites, Emperor, King Alfred and Sir Watkin, were free from infestation.

In California a total of 18 lots of bulbs was examined from 13 plantations and 9 of them were infested. In 4 lots where accurate records were kept, the infestation varied from 0.2% to 1%. In 4 lots where many bulbs were examined the infestation was so light that it was not definitely determined.

In Oregon 28 lots of bulbs were examined from 8 plantings and of these 16 were infested. In 10 instances the infestation was less than 1%. One was not determined, and the remaining five were as follows: 1.9%, 4%, 7.1%, 47.6%, and 52.7%.

In Washington 6 lots of bulbs from 5 plantations were examined and found to be infested. Two of them had infestations of 2.1% and 2.8% respectively; one was estimated at 15%, and three were not determined.







The following instance already mentioned under "Narcissus or Daffodil Fly", illustrates the degree of infestation that may be found in cullied imported bulbs when they are received in this country. Two flats of Golden Spur bulbs imported into Oregon during the fall of 1924, and forced in the greenhouse during the past winter showed infestations of 4.3% and 8.9% respectively, while a flat of imported Victoria bulbs forced under the same conditions was uninfested.

#### Economic Status of the Lesser Bulb Fly.

With respect to the economic status of the lesser bulb fly, the maggots when nearly full grown are usually found in very badly decayed bulbs, although in one or two instances they were seen feeding in the healthy tissue next to the rotted areas. Necessarily rotting must follow such heavy infestation. In life history studies conducted during the fall of 1924, female flies, fed on honey and confined in cages, when given a choice of healthy and rotted bulbs, deposited eggs only on the undersurface of the tightly clinging outer dry skins of the healthy bulbs. Eggs were never deposited on damaged or rotted bulbs as might have been expected even when confined with such bulbs.

Larvae which hatched from these eggs late in August passed through their normal development in onion and narcissus bulbs, which were perfectly healthy at the time that the eggs were laid on them. Some flies of this brood emerged during October and laid eggs on healthy bulbs for the succeeding generation which was also reared successfully. Young larvae were observed feeding in sound bulb tissue, and the larval mouth hooks are adapted for feeding in such tissue.

This information which was obtained from carefully conducted laboratory experiments indicates that this insect can not be classed merely as a scavenger, for it has been shown to be capable of attacking healthy bulbs. Information, however, is still lacking on the question of how infestation takes place under field conditions.

As an economic pest of onions the following evidence regarding the habits of the lesser bulb fly has been accumulated. On September 15, 1925, Prof. Don C. Mote, of the Oregon Agricultural Experiment Station submitted to the Bureau of Entomology several adult flies which had been bred from infested onions received from Oregon. Doctor Aldrich verified the identity of these specimens. Professor Mote also recently submitted a specimen of onion heavily infested with lesser bulb fly maggots. This is in agreement with the results of our experimental work during the past year in which this insect was successfully reared in onions under laboratory conditions. It also indicates that the fly can and does attack onions and may prove to be a pest of that crop. Moreover, in view





of its reputation as an onion pest in Europe, this insect deserves careful observation under field conditions to determine whether it is likely to assume a similar status in this country. Published records also indicate that this insect causes injury to parsnips in England.

In addition to ornamental bulbs, onions, and parsnips this insect has recently been found infesting iris rhizomes and yellow callas. Flies have been reared from larvae infesting iris rhizomes sent in recently from Takoma Park, near Washington, D. C. E. P. Felt, State Entomologist, has also published a note on its occurrence in iris rhizomes in several localities of central and eastern New York State. Entomologists of the California Department of Agriculture have recently found it infesting the yellow calla, Zantedeschia elliptica, and on previous occasions they have reported it as infesting Dutch, French and Spanish iris, Lilium auratum, and L. speciosum.

#### The Bulb Mite.

With reference to the status of the bulb mite as a narcissus pest the results of our examination indicate that, although present in virtually all plantings examined, the degree of infestation was so negligible that no attempt was made to determine the exact percentage. While its presence was generally associated with diseased or fly infested bulbs, it was also observed feeding in and injuring healthy bulbs. This agrees with previous observations by other workers in the Department.

Some growers were of the opinion that the mites were more injurious where the bulbs remained in the ground two or more years as compared to those which were lifted more frequently. This opinion was not substantiated by the results of observations in naturalized plantings in Virginia and North Carolina, in which instances the bulbs were found to be healthy and in excellent condition.

The bulb mite was also found to attack several Lilium candidum plants in a small planting at Mayfield, Calif. The nature of the injury demonstrated beyond doubt that it was a primary pest on this host. This verifies previous records received by the Bureau of Entomology in which it was reported to be a serious enemy of lilies.

In addition to the above records the mite has been reported by California Department of Agriculture officials, and also by one of the largest iris growers of that State as causing considerable injury to Dutch and Spanish iris.

It has also been found by Bureau experts to infest such major crops in greenhouses as Asparagus plumosus, A. sprengeri, and smilax. In these cases





the source of infestation may have been through the growing of imported bulbs close to these crops.

#### The European Tulip Aphid.

The subterranean form of this introduced species of aphid, Amuraphis tulipae Boyer, also known as the iris aphid, Aphis iridis Del Guercio, has been intercepted repeatedly in shipments of imported iris rhizomes, and Spanish iris bulbs.

On this survey it was reported as being quite a serious pest of tulips, iris and freesias, especially when the bulbs are dormant or in storage. It does not appear to be a serious pest of the growing bulb or plant. According to the California Department of Agriculture officials, as well as some of the larger growers, this aphid is quite a pest in seed and agricultural stores where bulbs are kept in storage before they are sold. Under storage conditions this aphid is easily controlled by treating the infested bulbs with nicotine dust, or calcium cyanide in a fumigatorium. It might be of interest at this point to refer to an article called to my attention by D. B. Mackie and which was published by F. V. Theobald in the Journal of the Ministry of Agriculture, London, May 1925, Vol. 32, No. 2, p. 154. In it the author points out that the subterranean form causes carrots to split underground.

#### Conditions on the Eastern Coast.

At the suggestion of officials of the Bureau of Plant Industry a survey was made of some of the long established and naturalized plantings of narcissus bulbs in North Carolina, Virginia, and Maryland to determine the present status of insect and mite infestation in the Eastern Coast region. If the original plantings which had not been subsequently exposed to infestation from imported bulbs were found to be free from infestation with the bulb flies and mites, it would indicate that these pests were not established in this section of the country and that bulbs in such plantings might afford a source of supply of clean and uninfested stock.

Accordingly naturalized plantings of narcissus in Elm City, Willard, Wilmington, and Southport, N. C., in localities where no foreign stock had recently been introduced were examined and found to be apparently free from bulb fly and mite infestation. The original stock in two of these naturalized plantings in North Carolina was believed to be over one hundred years old, and in one case definite records show that bulbs from this source had been growing in the same location at Southport for at least 34 years. Unfortunately in the case of one of these uninfested naturalized plantings at Wilmington, N. C., imported bulbs were introduced from Holland during the





fall of 1924 and 1925, which were found to be slightly infested with the lesser bulb fly and the bulb mite. At Castle Hayne, N. C., a shipment of King Alfred bulbs just received from Holland was heavily infested with the larger narcissus fly, Merodon equestris. Similarly, another lot of bulbs recently imported and planted at Orton Plantation, near Wilmington, N. C., was found to be infested with the lesser bulb fly, Eumerus strigatus.

In commercial plantings in the Tidewater region of Virginia, where the bulbs were being grown for cut flowers, infestation with the lesser bulb fly was noted only where bulbs had been imported from Europe during the past two or three years. A light degree of infestation with this fly was present in two of the six fields examined and this infestation appears to have had its origin in imported bulbs, since in each case recent introductions had been made. No bulb flies were found in the other four plantings where the original stock was unmixed and no foreign stock had been introduced. In one of the infested fields already mentioned the lesser bulb fly was found infesting native stock which had been lifted last year, and replanted, and it was also present in stock received from Holland during the last two or three years.

In a naturalized planting of narcissus near Silver Spring, Md., where the bulbs are grown for cut flowers, a sample of 600 bulbs was examined. Of these approximately three dozen were slightly damaged and they were cut open for further examination. No evidence of infestation with either of the bulb flies was found, but traces of a few bulb mites were found in several bulbs. All other bulbs appeared sound and clean.

In plantings of bulbs examined during the growing period which had been growing at Long Island, N. Y., for two or three years, Mr. C. F. Boucette of the staff of the Bureau of Entomology, reported the absence of both species of bulb flies.

The bulb mite was found in practically all lots of bulbs inspected, but the infestation was so light that it was negligible, and usually occurred in decaying material as already mentioned.

A significant feature of this survey is that the larger or narcissus fly was not found established in the bulb plantings examined in the Tidewater region of Virginia, North Carolina, Mississippi, or in Long Island, N. Y., in spite of the large numbers of bulbs that have been introduced into these regions during the last year or two.





### CONCLUSIONS.

Except in a few instances, none of the pests discussed in the previous pages appears to be present and established in sufficient abundance to constitute a really serious menace at this time. Nevertheless, the tremendous expansion which the bulb industry is now experiencing may tend to increase the risk of future injury. This is especially true in view of the fact that the economic status of the larger or narcissus fly in foreign countries is definitely recognized, and the lesser bulb fly is recorded as an economic pest of onions and parsnips in Europe. The lack of reliable and adequate information on their life history, habits, and control under American conditions makes it necessary, therefore, to study them thoroughly and determine their potentialities as possible pests of our staple agricultural crops.

To meet the exigency of this situation, a field station was established by the Bureau of Entomology at Santa Cruz, Calif., because both species of bulb flies and the bulb mite occur there and could, therefore, be studied to advantage. Mr. C. F. Doucette was transferred to Santa Cruz in August, and in addition to the life history studies, will try to develop effective control and remedial measures. Recent tests conducted by him and Mr. C. E. Scott, Pathologist, with hot water treatments have given very promising results and appear to indicate that this treatment may prove effective in controlling both bulb flies, as well as the mites, and nematodes. The efficiency of hot water sterilization and vacuum fumigation with various poison gases is now being fully investigated.

